Original Research Article

A study of post-partum persistence of glucose intolerance and its association with metabolic risk factors in gestational diabetes mellitus patients in urban South-Indian population

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Abstract

Background: Gestational diabetes mellitus, as a metabolic disorder affects 1%-28% of pregnancies. History of gestational diabetes is an important predictor of various metabolic disturbances later in life. This study was intended to observe the impact of the various predictors over persistence of abnormal glucose tolerance at post-partum and its association with metabolic risk factors.

Materials and methods: This was a prospective study of 216 GDM women diagnosed by 75 g oral glucose tolerance test (OGTT) during index pregnancy attending diabetology OPD in Institute of social obstetrics and Kasturba Gandhi general hospital between January 2016 to March 2018. At 6-12 weeks post-partum, 75 g - 2 hr-OGTT was done to assess their glycemic status. Data for predictors and metabolic risk factors were obtained from history, clinical examination and personal records. Plasma glucose was measured by glucose-oxidase method. The results were calculated using SPSS software and expressed in percentage.

Results: Of the 216 women only 173 patients came for postpartum follow up at 6- 12 weeks. Normal glucose tolerance (NGT) was seen in 58.9% and abnormal glucose tolerance (AGT) in 41.1%. The

frequency of abnormal glucose intolerance includes IFG: 0.9%, IGT: 24.5%, DM: 15.7%. Gestational age <20 week at detection of GDM, higher parity, insulin use during pregnancy, previous history of GDM, higher glucose levels on the diagnostic OGTT, hypertension were significantly higher in the AGT group. However positive family history of diabetes and BMI showed no statistically significant correlation.

Conclusion: It is concluded that advanced age, higher parity, previous history of GDM, earlier gestational age at diagnosis of GDM and use of insulin during pregnancy are important predictors for AGT during post-partum period and hypertension as a metabolic risk factor was strongly associated with AGT. Need for early postpartum screening and implementation of various intervention program to prevent type 2 diabetes in high risk GDM women.

Key words

Post-partum, Glucose intolerance, Gestational diabetes mellitus, South India. Metabolic risk factors.

Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance that is first recognized during pregnancy. Prevalence of gestational diabetes mellitus (GDM) varies among different population [1]. Incidence of GDM is increasing which is attributed to rise in obesity, metabolic syndrome and advancing maternal age. Usually soon after delivery, 90% to 95% women with GDM are diabetes-free by 75g OGTT. By 6-12 weeks post-partum, 4% to 9% are diagnosed with type- 2 DM; more than 20% have prediabetes [2]. It is also evident from previous studies that 5 to 10 percent of women with GDM are found to have type 2 diabetes within 6 months after delivery and 35 to 60 percent develop type 2 DM in next 10 to 20 years [3].

International guidelines recommend early screening of glucose for detection of prediabetes or diabetes in women with gestational diabetes at 6–12 weeks postpartum using the 75 g 2 h oral glucose tolerance test (OGTT) [4]. Women with a history of GDM are not only at a higher risk of type 2 DM, but also vascular dysfunction, cardiovascular disease and metabolic syndrome [5]. Potential predicators of future progression of prediabetes and/or diabetes in women with gestational diabetes are pre-pregnancy body mass index (BMI), higher blood glucose level in pregnancy, ethnic groups, earlier diagnosis of GDM, requirement of insulin therapy during pregnancy, and advanced maternal age, smoking, physical inactivity, diet and drugs that adversely affect glucose metabolism [6, 7].

Common universal features of GDM reported in recent studies include a rising trend in incidence of the condition [8] increasing prevalence of its risk factors [9], a high rate of metabolic and cardiovascular outcomes, earlier progression to prediabetes and type 2 diabetes [10]. Therefore, early identification of women with greater risk of progression to diabetes may provide opportunity for prevention and intervention program. This study was intended to detect the rate of persistence of glucose intolerance in GDM patients during 6-12 weeks post-partum follow-up and to identify risk factors for future diabetes incidence.

Materials and methods

This was a prospective study of 216 GDM women diagnosed by 75 gm oral glucose tolerance test (OGTT) during index pregnancy attending diabetology OPD in Institute of social obstetrics and Kasturba Gandhi general hospital between January 2016 to March 2018. A proforma containing general information on demographic characteristics, parity, family history of diabetes, OGTT report and insulin use during pregnancy etc. was filled up. Clinical evaluation including estimation of height, weight, BMI (kg/m^2) and BP (mmHg) were measured by calibrated instrument. All women

were followed up until delivery. At the discharge from the hospital they were instructed to come for 75-g OGTT 6 -12 weeks. All the patients had been on unrestricted carbohydrate diet for 3 days and came to diabetology OPD after an overnight fast (at least 8 hr but not more than 14 hr) to undergo a 75-g 2-h OGTT at 6-12 weeks post-partum. Plasma glucose was measured by glucose-oxidase method. All participants signed an informed written consent, and the hospital ethical committee approved the study protocol.

Statistical analysis

All data were analyzed by SPSS program (version 22.0) and expressed as mean ± SEM or in frequency or percentage. Correlation between glucose level and age of subject, gestational age at diagnosis of GDM, BMI were analyzed by Pearson's and/or Spearman correlation. P values ≤ 0.05 were considered statistically significant.

Results

Of the 216 women included in the study, only 173 patients came for postpartum glucose testing at 6 -12 weeks. Of the 173 patients studied, normal glucose tolerance (NGT) was seen in 58.9% and abnormal glucose tolerance (AGT) in 41.1% of patients. The frequency of various categories of abnormal glucose intolerance include IFG: 0.9%, IGT: 24.5%, DM: 15.7% respectively. Abnormal glucose intolerance was most common in age group 30-35 year (50%,) and the commonest glucose abnormality was IGT (56.2%,) followed by DM (32.7%). Gestational age <20 week at detection of GDM ($p<0.001$), higher parity ($p<0.05$) as well as insulin use during pregnancy ($p<0.001$) were also significantly higher in the AGT group. There was no statistical difference among the trimesters. Previous history of GDM ($p<0.001$), higher glucose levels on the diagnostic OGTT($p<0.001$) and hypertension ($p<0.001$) were also found statistically significant in the AGT group. However, a positive family history of diabetes and BMI showed no statistically significant correlation (**Table – 1, Table – 2**).

Table - 1: Characteristics of studied subjects.

Character	**Value (%)**
Total no of patients	173
Age (mean ± SD, year)	30.6 ±5.3
BMI (Kg/m^2, mean ± SD)	26.8±3.7
Parity	
1	61(35.2%)
2	74(42.7%)
≥3	38(21.9%)
Family H/O GDM	108(62.4%)
Gestational age at detection of GDM	
<20 weeks	57 (32.9%)
≥ 20 weeks	116(67%)
Insulin use during pregnancy	68 (39.3%)

Discussion

In our study, we studied the rate of persistence of glucose intolerance and impact of various risk factors that predicts the persistence of glucose intolerance at 6-12 weeks post-partum. We found that normal glucose tolerance (NGT) 58.9% and abnormal glucose tolerance (AGT) 41.1% was seen in GDM patients at 6 -12 weeks postpartum. The frequency of abnormal glucose intolerance includes IFG: 0.9%, IGT: 24.5%, DM: 15.7% respectively. Our results were consistent with study by Tovar, et al. [11] which reviewed 11 studies and found that proportion of diabetes was 1.2–4.5% and prediabetes 12.2–36%, at 6–12 weeks postpartum. A study on Asian women by Jang, et al. [12] also showed the incidence of diabetes at 6 – 12 weeks postpartum as 5–15%. Kwak, et al. [13] studied 843 Korean GDM mothers and reported a 12.5% rate of persistence at 2 months postpartum and 23.8% at 1 year.

It was observed that advancing age, multiparity, previous h/o GDM, earlier gestational age (<20 week) at GDM detection, insulin use during pregnancy all were significantly higher in the group of AGT. A systematic review on 39 studies including 95,750 women by Rayanagoudar, et al. [14] demonstrated higher risk of progress to abnormal glucose tolerance in women diagnosed with GDM in early weeks of gestation (RR 2.13, 95% CI 1.52–3.56). Kim, et al. [15] described the degree of severity of

glucose intolerance in pregnancy as the most important independent predictor of persistence of AGT.

In the present study, use of insulin for management of hyperglycemia in pregnancy was strong predictor of progression to abnormal glucose tolerance at 6–12 weeks postpartum. A study by Pellonperä, et al. [16] in GDM women, showed higher incidence of prediabetes in insulin users (15.6%) than women treated with diet only. A study by Ziegler, et al. [17] showed 92.3% of German women who used insulin in pregnancy progressed to diabetes during the 15-year period after GDM pregnancy versus 39.7% in the diet treatment group.

Table - 2: Comparison of risk variables between AGT and NGT.

Variable	Abnormal glucose tolerance (n =71)	Normal glucose tolerance (n =102)	P value
Age (Mean ± SD, year)	30.3 ± 5.8	29.1 ± 4.5	<0.001
BMI (Mean ± SD, Kg/m^2)	27.9 ± 4.7	25.3 ± 4.5	0.094
Parity			
1	14(24.1%)	44(75.9%)	≤0.001
2	33(40.5%)	44(59.5%)	
≥ 3	24(63.1%)	14(36.9%)	
Family H/O DM			
Present	52 (48.2%)	56 (51.8%)	0.138
Absent	19(29.3%)	46(70.7%)	
Insulin during pregnancy			
YES	55 (80.8%)	13(19.2%)	<0.001
NO	16(15.2%)	89 (84.8%)	
Gestational age at detection of GDM			
< 20 weeks	28(65.1%)	15(34.9%)	<0.001
≥ 20 weeks	43 (33%)	87(67%)	
Previous GDM			
Yes	28 (66.6%)	14(33.4%)	<0.001
No	43(32.8%)	88(67.2%)	
Hypertension			
Present	53(57.6%)	39 (42.4%)	<0.001
Absent	18 (22.2%)	63 (77.8%)	

Of the CVD risk factors -hypertension was found to be significantly higher in AGT group however obesity/ overweight or family history was not statistically significant. A systematic review and meta-analysis by Rayanagoudar, et al. [14] showed hypertensive disorder in pregnancy (RR 1.38; 95% CI; 1.32–1.45) was associated with future diabetes. Feig, et al. [18] showed that women with hypertensive disorder in pregnancy had a 2-fold increased risk of developing diabetes.

In our study, no significant association was found in total weight gain during pregnancy, BMI, and postpartum glucose intolerance at 6 weeks postpartum. Women with higher blood glucose levels, who had a high chance of early postpartum progression to abnormal glucose intolerance, usually received a strict diet program that controlled their weight gain during pregnancy. A study by Lobner, et al. [19] reported BMI as a significant risk factor for progression to glucose intolerance after GDM pregnancy, but there was no significant correlation in our study.

Our study has limitations. The rate of postpartum return for glucose testing and follow-up was low. despite repeated reminder over the telephone. A convenient window period of 6-12 week post-delivery was offered for the benefit of the mothers, yet many failed to respond.

Conclusion

Gestational diabetes is a risk factor for postpartum progression to glucose intolerance. Short-term postpartum follow-up of women with GDM showed a relatively high rate of glucose intolerance among women in this population. Out of the predictors of persistence of post-partum AGT, advancing age, multiparity, earlier gestational age at GDM detection (<20 week), insulin use during pregnancy, higher glucose value at detection of GDM were important statistically. Of the CVD risk factors hypertension was found to be significantly associated with postpartum persistence of glucose intolerance. Continued follow-up over time is required, as because the NGT might convert to AGT thereby increasing the prevalence of persistence. So universal screening of GDM among our pregnant population with mandatory post-partum follow-up should be made feasible. Need for early postpartum screening and implementation of various intervention program to prevent type 2 diabetes in high risk GDM women.

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